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DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION TEST BOARD
Fort Rucker, Alabama 36360

SPFBG-1D

AUG 19 1968

SUBJECT: Letter Report, "Product Improvement Test of UH-1()
Symmetrical Engine-to-Transmission Drive Shaft,"
USATECOM Project Number 4-5-0101-10 ✓

⑨ Letter Report

⑪ 19 Aug 68

⑫ 6p.

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⑫ USATECOM-4-5-0101-10

1. REFERENCES

a. Letter, AMSTE-BG, Headquarters, US Army Test and Evaluation Command, 1 June 1965, subject: "Product Improvement Test, UH-1B Items, USATECCM 4-5-0101-()."

b. UH-1 Test Coordination Meeting, 30 August 1966.

c. Letter, AMCPM-IRFO-T, Iroquois Field Office, US Army Materiel Command, 21 September 1967, subject: "Product Improvement Test of Improved Drive Shaft, USATECOM 4-5-0101-10."

d. Letter, AMCPM-IRFO-T, Iroquois Field Office, US Army Materiel Command, 17 October 1967, subject: "Product Improvement Test of Improved Drive Shaft, USATECOM 4-5-0101-10."

e. Letter Partial Report of Test, "Product Improvement Test of UH-1 Symmetrical Engine-to-Transmission Drive Shaft," USATECOM Project Number 4-5-0101-10, US Army Aviation Test Board, 8 January 1968.

2. BACKGROUND

a. The UH-1() engine-to-transmission standard drive shaft is being removed at an average of 532 flight hours, instead of achieving its time

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between overhaul of 1,100 hours. The major problem encountered is pitting of the splines. This condition is attributed to high operating temperatures, which result from high mission gross weights and combat-type maneuvering of the helicopter. The lubricant tends to deteriorate at the operating temperatures encountered, thus requiring inspection and lubrication of the shaft at 100-operating-hour intervals. In addition, the standard shaft can be easily installed backwards. If this happens, the shaft is not cooled properly and fails after a short operating time.

b. In an attempt to increase the life of the shaft and to increase the inspection and lubrication intervals, the Iroquois Project Manager directed (reference b) the test of an improved drive shaft. The US Army Test and Evaluation Command (USATECOM) directed the US Army Aviation Test Board (USAAVTBD) to conduct the test.

3. DESCRIPTION OF MATERIEL

Primary differences between the new shaft and the standard shaft are:

a. Elimination of the cooling fin, allowing the shaft to be installed in either direction and still be properly cooled.

b. Construction of splined couplings of new materials (M50 tool steel and nitralloy "N") to provide better resistance to the high operating temperatures.

c. Lubrication of the new shaft with Anderol L-786 (FSN 9150-926-1969), which is designed to withstand higher temperatures than the EP-2 lubricant formerly used.

4. OBJECTIVE

To determine the suitability of the test drive shaft as compared to the standard UH-1() drive shaft.

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5. SCOPE AND METHOD

The USAAVNTBD conducted this Category II product improvement test at Fort Rucker, Alabama, during the period October 1967-July 1968. The three test shafts were installed on two UH-1H Helicopters and one AH-1G Helicopter. The test shafts were inspected and tested by three different methods:

a. Test shaft, serial number (S/N) A 20-089, was installed on AH-1G, S/N 66-15249, on 20 October 1967, at 485.0 aircraft hours.

(1) The shaft was lubricated with Anderol L-786 (FSN 9150-926-1969).

(2) The shaft was inspected daily for leakage of grease.

(3) After 25 hours of operation the shaft was removed, both ends were internally inspected, and the shaft was reinstalled.

(4) The engine end of the drive shaft was scheduled to be reinspected internally after 300 hours of operation, with additional inspection requirements pending the outcome of this inspection.

b. Test shaft, S/N A20-077, was installed on UH-1H, S/N 66-1093, on 13 November 1967 at 1,693.0 aircraft hours.

(1) The shaft was lubricated with Anderol L-786 (FSN 9150-926-1969).

(2) The engine end of drive shaft was marked.

(3) The shaft was inspected daily for leakage of grease.

(4) After 100.0 hours of operation, the shaft was removed and inspected internally at both ends, and reinstalled with the marked end toward the engine.

(5) At 250, 400, 550, 700, 850, and 1,000 hours the drive shaft installation was reversed.

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(6) At 400, 700, and 1,000 hours the drive shaft was removed and the marked end inspected internally.

(7) At 1,111.5 hours the drive shaft was removed and both ends inspected internally.

c. Test shaft, S/N A 20-056, was installed on UH-1H, S/N 66-1094, on 17 November 1967 at 1,848.8 aircraft hours.

(1) The shaft was lubricated with Anderol L-786 (FSN 9150-926-1969).

(2) The shaft was inspected daily for leakage of grease.

(3) The shaft was not internally inspected, reversed, or otherwise disturbed until the end of the test.

(4) The drive shaft was removed and inspected after 1,105 hours of operation.

6. SUMMARY OF RESULTS

a. Test drive shaft, S/N A 20-089, failed after attaining 148.4 test hours. Cause of the failure is unknown. (See paragraph 7.)

b. Test drive shaft, S/N A 20-077, was inspected after completion of 1,111.5 operating hours, and no pitting or unusual wear was noted.

c. Test drive shaft, S/N A 20-056, was inspected after completion of 1,105.0 operating hours, and no pitting or unusual wear was noted.

7. DISCUSSION

a. Test drive shaft, S/N A 20-089, was inspected at 25.0 flight hours and was in serviceable condition. At 106.0 flight hours it was removed and reinstalled because of an engine change on the aircraft. Through maintenance error the shaft was reinstalled with the position

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reversed from that required by the plan of test. This error was spotted after another 25.7 flight hours and the shaft was reversed to the desired installation. Sixteen flight hours later, the shaft was removed because of leaking of the flex seal. The peculiarity of the failure leads to suspected maintenance error during removal and reinstallation.

b. The test was planned to be conducted on six test items; however, only three improved shafts were received for testing. No test item was available for installation on an AH-1G after the failure of shaft S/N A 20-089. The Iroquois Project Manager was informed of the lack of a test shaft for replacement on an AH-1G; however, no replacements were received.

c. Because of the early failure, and the peculiarity of the failure, of the shaft in the AH-1G, it is felt that the test results for this aircraft are not sufficient to warrant a conclusion. The test results obtained with the UH-1H are not considered conclusive with respect to the AH-1G since the missions of the two aircraft differ greatly. Further testing should therefore be conducted with the drive shaft in the AH-1G in an attempt to obtain conclusive results.

8. CONCLUSION

The symmetrical engine-to-transmission drive shaft is a suitable replacement for the standard shaft on all affected UH-1() helicopters.

9. RECOMMENDATIONS

It is recommended that:

a. The symmetrical engine-to-transmission drive shaft be installed on all affected UH-1() helicopters.

b. The shaft be inspected after the first 25 hours of operation and again after each 600 hours of operation.

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c. Further testing of the shaft be conducted on the AH-1G
Helicopter.

for David M. Kyle
DAVID M. KYLE
Colonel, Artillery
President

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